Marty

MEMORANDUM

To: NCC Distribution List

From: BPC

Subject: NCC Operators Guide

Date: November 29, 1972

Here is your copy of the current NCC Operator's Guide. This guide describes the version of the NCC program running at the moment.

An illustration goes on page 2 of the appendices, and it is forthcoming. Be patient.

Since the guide is now in a runoff file in the PDP-1, it is quite easy to update and reissue. Please feel free to give me any comments or suggestions for improvements, correct little errors, etc.

BPC/ph

NCC Operator's Guide

Contents

Introduction

For the operator, the NCC's major function is to accumulate information about events occurring around the network and present it promptly. This manual is intended to help the operator understand what the NCC is trying to tell him, and to point out the ways in which the NCC can be altered to make it more useful.

The manual consists of two major sections. The first describes the status reporting aspects of the program, and should be the one of main interest for the operator. The second contains descriptions of the various types of statistics on network activity that the NCC compiles. Information which is of little or no interest to the operator but useful for others who will have occasion to use the NCC has been relegated to the appendices.

Section I: Monitoring the Network

Each IMP in the network regularly sends the NCC a shapshot of its environment. The NCC takes these snapshots and integrates them into a single picture of the state of the network as a whole. This larger view is presented in two ways: on a bank of lights and as a continuous log.

The Lights

The lights display console conists of 64 lights, 16 switches and an alarm. The lights display the status of various elements of the network. A light on means that the associated element is functioning, and a light off means either that the element is not functioning, or that due to multiple failures in the network, the element has become isolated away from the NCC(5). The lights normally display IMP status, but the switches allow the selection of line status.

Whenever an IMP or line becomes non-operational, the alarm will be sounded: continuously for IMP failures, and in bursts for line failures. In addition, if the appropriate display is selected the light for that network element is flashed. When the operator has taken note of the problem, a switch allows him to turn off the alarm and the flashing light. The switch assignments are:

12: Display line status in the plus direction(1) for

---

(5) In this case the network element is usually referred to as being "invisible". Invisible elements are displayed as if down in the lights, but the Quickprint (q.v.) continues to give the NCC's best guess on the state of

the line.

13: Display line status for the minus direction of the lines.

15: Lamp Test -- turns on all the lights.

16: Reset alarm and flasher.

---

(1) The ends of each line are identified as being either the "plus" end or the "minus" end. Normally, the higher numbered IMP is defined to be the plus end. The plus direction of a line is from the minus end toward the plus end.

The Log

As events occur around the network, the NCC records their occurrence on the logging Teletype. The format for an entry is:

when who event, event, event

Most of the logger entries are self-explanatory, or at worst, will require a reference to the IMP Operating Manual. The ones that are least lucid are:

IMP Events

VERSION n

The node is, or was, running the incorrect version of the IMP system. In the latter case, the typeout indicates that the IMP is now running the correct version.

HOST n TEST ON
HOST n TEST OFF

The IMP is commencing a loop test of the indicated Host interface.

HOST TEST n/m

The results of a testing period. The Host was interrogated m times and responded successfully n times.

FREE LIST n
SF COUNT n
REAS COUNT n
ALLOCATE COUNT n

These indicate that one of the IMP's internal storage constraints has been exceeded. Unless the condition persists, these can usually be ignored.

TRAP: (n,m,o)

The IMP, or TIP, system has detected an internal error. A member of the software staff should be notified.

HOST34=n

The IMP system is incorrectly initialized for its configuration. This will usually require changing the IMP's configuration control word, and having the IMP then reinitialize itself.

Line Events

ERRORS PLUS n/m
ERRORS MINUS n/m
: The IMP has tested the line in the indicated direction m times and n of those were unsuccessful.

CONNECTED TO MODEM n AT SITE m
: The line is not plugged into the proper modem interface.

IN LIMBO
: The IMPs at either end of the line are not agreeing as to whether the line is operational or not.

NCC Events

NCC LOG FULL
: The NCC's internal queue for events to be logged has overflowed. Some events have been lost.

DDT

Many of the parameters which govern various NCC activities are alterable dynamically by means of a DDT which is run from the Summary Teletype. This DDT is essentiallv the same as the IMP DDT(3), and so this will be a description of only the differences of the NCC's DDT from the IMP's.

! Clears the queue of events to be logged.

?Quickp:
Initiates the listing, on the summary Teletype, of the current anomalies in the network; that is, those condtitons which are deviations from the nominal state. The character conventions for the Eight Hour Summary is used in reporting the IMP and line status.

?Host status:
Initiates a listing, on the summary Teletype, of which Hosts are up. The character conventions for the Eight Hour Summary are used in reporting the IMP status.

The following commands are not implemented: O, C, T, I, L, H, $ and <.

---

(3) See section 3.2.3 of The IMP Operating Manual.

Modifying Parameters

Many of the NCC's activites are governed by various parameters which limit and define their domains. DDT is used to examine and change the settings of these parameters. The following are the parameters, the first column giving the location of the parameter, in octal, and the second giving the function of the parameter.

1Ø5	Minutes since the last hour.
1Ø6	Hours past midnight
1Ø7	Day of the month
11Ø	Month of the year
111	Low two digits of the year.
-->	When any of 1Ø5-111 are changed, the NCC should be restarted.
12Ø	Nominal version number for the IMP system. 177777 indicates that the version number should not be checked.
121	Non-zero if the Summary Teletype does not have a page feed.
122	Non-zero if the Logging Teletype does not have a page feed.
123	Maximum number of errors that will be tolerated on an operational line before the errors will be logged.
124	Maximum number of errors for a non-operational line to have to be declared "Down without Errors"(4).
125	Minimum length tolerated for Free List without logging.
126	Maximum length tolerated for Free List without loggint.
127	Minimumi Store and Forward Count tolerated without logging.
13Ø	Maximum Store and Forwwrd Count tolerated without logging.
131	Minimum Reassembly count tolerated without logging.
132	Maximum Reassembly count tolerated without logging.
133	Minimum Allocate Count tolerated without logging.
134	Maximum Allocate Count tolerated without logging.
135+n	Definition of site n: 177777 if a 316 IMP, Ø

---

(4) See Appendix III.

if a 516 IMP, and the appropriate TIP system version number if a TIP.

215+n	Configuration control word for site n (HOST34).
7ØØØ+n+n	Minus end of Line n: xxy indicates modem y at site x.
7ØØ1+n+n	Plus end of Line n, as above.

Section II: Measuring the Network

In addition to reporting its environment, each IMP also sends the NCC statistics on its Hosts' activity and its line utilization. These are compiled and reported periodically on the summary Teletype.

Summary Reports

Every Hour

The NCC reports the Host and line traffic during the previous hour.

Every Eight Hours

The NCC reports the Host and line traffic from midnight through the previous hour. It also types a compact log of the status of the IMPs and lines since midnight. In these, the times of events are rounded to fifteen minute intervals, and the following codes are used:

?	Unknown
*	Down
+	Down in the plus direction (lines only)
-	Down in the minus direction (lines only)
<	Plus end looped (lines only)
>	Minus end loopd (lines only)
Z	Both ends looped (lines only)
X	Status changed during the interval

Every Twenty-four Hours

The NCC types an abbreviated summary of the Host traffic for the entire day.

Measurement related DDT Commands

In order to provide more flexibility and control, DDT has been augmented with the following commands:

?Status:
: Initiates the typeout of the Host and line status summary from midnight through the prosent fiftenn minute period.

?Hoursum:
: Initiates a copy of the last hourly report.

?Daysum:
: Initiates a typeout of the Host and line activity from midnight through the end of the last hour.

?Pktsum:
: Initiates the abbreviated Host traffic summary from midnight through the end of the last hour.

Hitting the BREAK key
: Suspends summary typeout for about one minute to allow the use of DDT. The summary will start over from the beginning when it resumes.

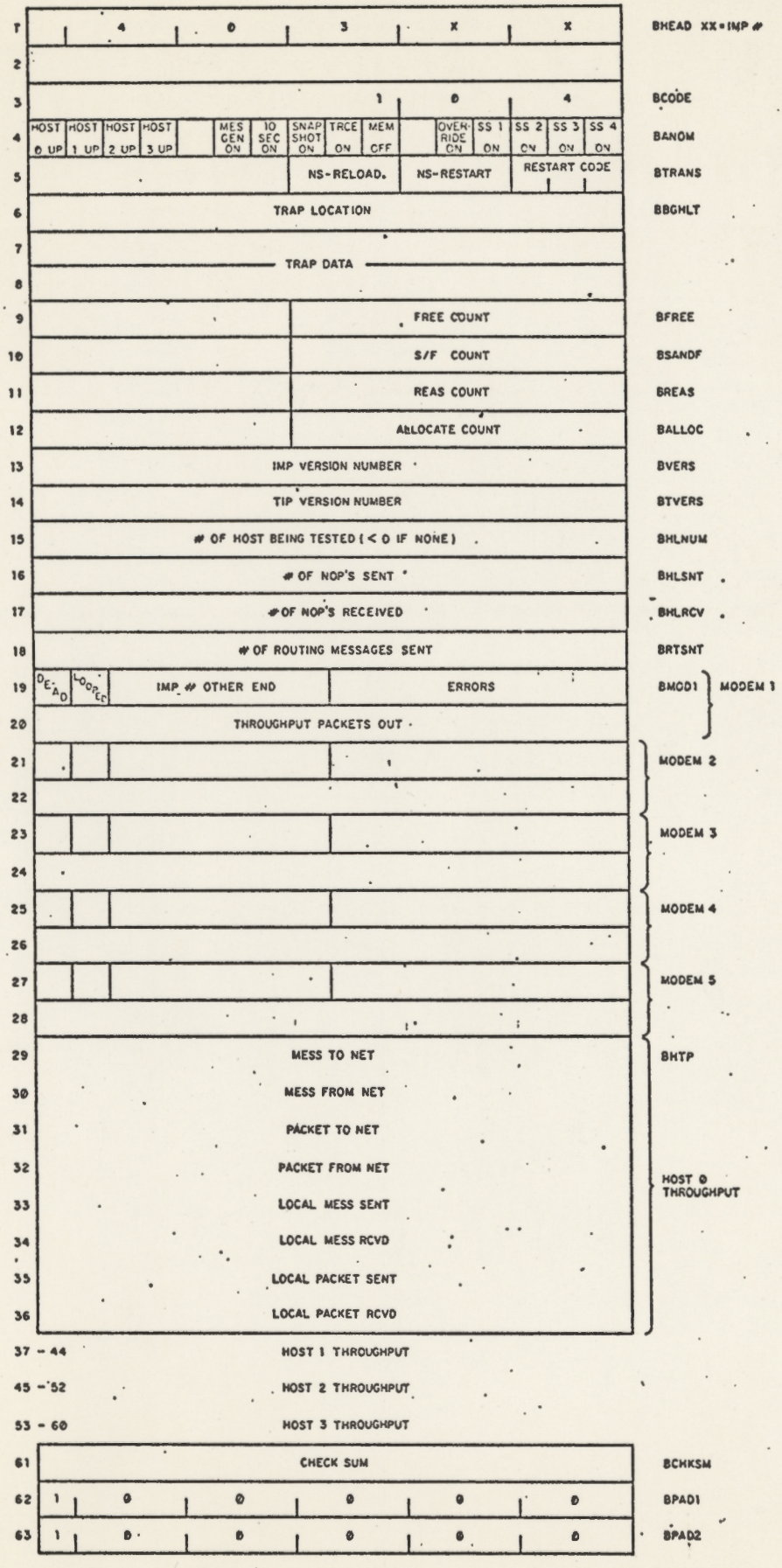
;
: If any summary request is terminated with a semicolon instead of a colon, the NCC will delay before commencing on the summary. Thus, many different summarys can be requested simultaneously.

Reporting to the NCC

IMPs report to the NCC every 52 seconds. The IMPs cooperate in the maintenance of a network wide clock so that these reports will be sent simultaneously from all sites. In addition to these synchronous reports, an IMP will send an extra report when any of the following occur:

1) Change in a sense switch setting.
2) Change in the setting of memory protect.
3) The IMP was restarted or reloaded.
4) The IMP, or TIP, encountered a "trap".
5) Enabling or disabling of any statistics subprogram.
6) Change in the status of Host test mode.

The following figure describes the report that the IMPs send to the NCC. The checksum is the two's-complement sum of all the data words of the message, including the report version number (BVERS). The words in boldface: BVERS, BANOM, etc, are the names by which the NCC software accesses the associated data.


1 4 0 3 X X BHEAD XX=IMP #
2
3 1 0 4 BCODE
4 HOST 0 UP | HOST 1 UP | HOST 2 UP | HOST 3 UP | MES GEN ON | 10 SEC ON | SNAP SHOT ON | TRCE ON | MEM OFF | OVER-RIDE ON | SS 1 ON | SS 2 ON | SS 3 ON | SS 4 ON BANOM
5 NS-RELOAD. NS-RESTART RESTART CODE BTRANS
6 TRAP LOCATION BBGHLT
7 TRAP DATA
8
9 FREE COUNT BFREE
10 S/F COUNT BSANDF
11 REAS COUNT BREAS
12 ALLOCATE COUNT BALLOC
13 IMP VERSION NUMBER BVERS
14 TIP VERSION NUMBER BTVERS
15 # OF HOST BEING TESTED (< 0 IF NONE) BHLNUM
16 # OF NOP'S SENT BHLSNT
17 # OF NOP'S RECEIVED BHLRCV
18 # OF ROUTING MESSAGES SENT BRTSNT
19 DEAD | LOOPED | IMP # OTHER END | ERRORS BMOD1 MODEM 1
20 THROUGHPUT PACKETS OUT
21 MODEM 2
22
23 MODEM 3
24
25 MODEM 4
26
27 MODEM 5
28
29 MESS TO NET BHTP
30 MESS FROM NET
31 PACKET TO NET
32 PACKET FROM NET HOST 0 THROUGHPUT
33 LOCAL MESS SENT
34 LOCAL MESS RCVD
35 LOCAL PACKET SENT
36 LOCAL PACKET RCVD
37 - 44 HOST 1 THROUGHPUT
45 - 52 HOST 2 THROUGHPUT
53 - 60 HOST 3 THROUGHPUT
61 CHECK SUM BCHKSM
62 1 0 0 0 0 0 BPAD1
63 1 0 0 0 0 0 BPAD2

The NCC Program

The NCC is designed to run continuously without any attention required of the operator. In the event that something does happen to the program requiring intervention, there are several things the operator must know.

The operational tapes drawer in the IMP area contains three items of interest: two paper tapes, NCC and NCCLOD, and a sheet of patches for the NCC program. The NCC paper tape contains the complete NCC program, without most of its tables; thus, allowing the operator to load a fresh copy of the program over an old one and retaining the old parameter settings and accumulated data. The NCCLOD paper tape contains only those routines necessary to effect a load of the NCC, and will only be used in the event that the NCC must be moved to a different machine. The patch sheet contains a list of words to be changed with "stand alone" DDT before starting up the NCC proper.

The NCC program has five entry points:

1ØØØ	Fresh start - all tables are cleared.
1ØØ1	Restart - tables are left intact
1ØØ2	Dump the NCC, and all its tables, through modem 1.
1ØØ3	Load the NCC, and all its tables, from modem 1.
1ØØ4	Stand Alone DDT - all NCC activities beyond running DDT are suspended. This is primarily used by the software staff for debugging.

The switches on the NCC machine proper, not to be confused with the switches on the lights display, perform the following functions:

SS2 Disables the display console. To be used in the

event that the NCC must run in a machine without a lights display. This should never occur operationally.

SS4 As with the IMP, this sense switch enables the ability of DDT to modify memory.

Line Status Determination

Each IMP can, of course, only report on the status of its end of any given line. One of the tasks of the NCC is to take the reports from each end of a line and determine an overall status for that line.

IMPs report their lines as being in one of three states: up, down or looped. The NCC expands these to five by using the clip in word 124 to make a report of "down" become either "Down, no Errors" or "Down with Errors", and by using the status "No Info" when there has been no recent report from the IMP.

Line status is then determined, each minute, by using the latest reports from each end of the line, or "No Info" where appropriate, together with the following table:

MINUS END \ PLUS END	No Info	Up	Down, no errors	Down with errors	Looped
No Info	Unknown	Up	Unknown	Unknown	Looped plus
Up	Up	Up	limbo	limbo	limbo
Down, no errors	Unknown	limbo	Down	Down plus	Looped plus
Down with errors	Unknown	limbo	Down minus	Down	Looped plus
Looped	Looped minus	limbo	Looped minus	Looped minus	Looped both

If a change in status, other than to or from LIMBO, is detected, the following actions are performed:

1) A logger message is printed.

2) The new status is recorded in the line status table.
3) The line lights display is set as follows:
    1) UP - Turn on both plus and minus lights, and turn off flashing.
    2) DOWN MINUS - turn on plus, turn off minus, and turn on flashing.
    3) DOWN PLUS - turn off plus, turn on minus, and turn on flashing.
    4) All other states - turn off both lights, and turn on flashing.

If the transition is into LIMBO, only a logger message is typed, and the former state is retained. Thus, the line never actually goes into LIMBO, and subsequent statuses are handled as though the LIMBO had not occurred.

Index

In the following index, page numbers of the form "n-m" refer to items within the main sections of the report, while page numbers of the form "n" refer to items in the appendices.